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EXAMINER
THOMPSON, JAMES A

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/586,884	Applicant(s) KONNO ET AL.	
	Examiner James A Thompson	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 January 2005 and 04 October 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,17,34-52,56,60,64,68,78-84 and 90-92* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,17,34-52,56,60,64,68,78-84 and 90-92* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 June 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. The arguments listed in Applicant's arguments dated 04 October 2004 have been fully considered and are addressed in the Advisory Action mailed 29 November 2004. The amendments to the claims filed 04 October 2004 have been entered due to Applicant filing a Request for Continued Examination (RCE) on 03 January 2005. The claims as currently filed are addressed below.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 17, 34-37, 39-42, 48-52, 56, 60, 64, 68 and 90-92 are rejected under 35 U.S.C. 102(b) as being anticipated by Curry (US Patent 5,696,604).

The apparatus of claim 17 performs the method of claim 1, the steps of the program codes of claim 34, and the method of claim 35. Claims 1, 17, 34 and 35 are therefore discussed together.

The apparatus of claim 48 performs the method of claim 60. Claims 48 and 60 are therefore discussed together.

The apparatus of claim 52 performs the method of claim 64. Claims 52 and 64 are therefore discussed together.

The apparatus of claim 56 performs the method of claim 68. Claims 56 and 68 are therefore discussed together.

All of the limitations of claims 90 and 91 are embodied in claim 92. Claims 90-92 are therefore discussed together.

Regarding claims 1, 17, 34 and 35: Curry discloses an image recording apparatus (figure 1 of Curry) for performing recording using a dot pattern corresponding to each gradation value (column 3, lines 60-67 of Curry), based on image data representing each pixel with a gradation value (column 3, lines 66-67 of Curry), comprising an input unit (figure 1(12) of Curry) for inputting image data (column 3, lines 60-64 of Curry) including gradation value information (column 4, lines 1-7 of Curry) and position information relating to each pixel (column 4, lines 30-39 and column 7, lines 11-14 of Curry); a dot pattern table storage unit (figure 1(26) of Curry) for storing a dot pattern table having a plurality of different dot patterns (column 6, line 67 to column 7, line 7 of Curry) associated with gradation value (8-bit intensity) and position information (5-bit x-coordinate and 5-bit y-coordinate) (column 6, lines 63-67 of Curry). The dot-pattern-table storage unit stores 2^{18} permutations of halftone cell configurations, using 18 bits for addressing the permutations (column 6, lines 63-67 of Curry). 8 bits are used for the grayscale (intensity) values (column 6, lines 65-66 of Curry) and 10-bits are used for the position information of the halftone cell, 5 bits for the x-coordinate and 5 bits for the y-coordinate (column 6, lines 63-67 of Curry).

Curry further discloses selection means (figure 1(52) of Curry) for selecting one dot pattern from said dot pattern table storage unit (column 7, lines 14-22 of Curry), based on gradation value information (v of (x,y,v) set of coordinates) and position information ((x,y) of (x,y,v) set of coordinates)

(column 7, lines 20-24 of Curry) indicated by each pixel of the image data input by said input unit (column 7, lines 11-18 of Curry); and a recording control means (figure 1(56) of Curry) for controlling a recording head so as to record an ink dot based on the dot pattern selected in said selection means on a recording medium (column 7, lines 22-25 of Curry), wherein the dot pattern table has a plurality of different dot patterns (column 6, lines 63-66 of Curry), each having the same dot number and a different dot arrangement corresponding to the same gradation value (column 6, line 67 to column 7, line 7 of Curry). For a 5-bit representation of x-coordinates, a 5-bit representation of y-coordinates, and an 8-bit representation of gradation values, there are 2^{18} permutations, and thus memory addresses, of dots. Therefore, there are 2^{10} permutations of dot arrangements for each gradation level.

Curry further discloses that the plurality of different dot patterns (figure 6 of Curry) corresponding to the same gradation value (column 7, lines 3-7 of Curry) are associated with a plurality of pixel positions (column 6, lines 63-66 of Curry) corresponding to a plurality of pixels arranged in a first direction substantially corresponding to the direction of arrangement of a nozzle of the recording head (column 6, lines 43-46 of Curry). Printing and calculations are performed based on the fast scan and slow scan directions (column 6, lines 43-46 of Curry). For an ink jet printer, it is inherent that a first scan direction, specifically the fast scan direction, is the direction of the arrangement of nozzles.

Further regarding claims 34 and 35, recording an ink dot based on the dot pattern selected in said selection means is also considered an output step for outputting said dot pattern.

Regarding claim 36: Curry discloses that the dot pattern table is a two dimensional table expanding in two directions, since the various gray values are stored in the look-up table based partly on the x-y coordinate of the halftone cell (column 7, lines 3-7 of Curry). Printing and calculations are performed based on the fast scan and slow scan directions (column 6, lines 43-46 of Curry). It is inherent in ink jet and laser jet printing (column 3, line 63 of Curry) that the slow scan direction is in the direction of the recording head. For an ink jet printer, it is inherent that the fast scan direction is direction of the arrangement of nozzles. Therefore, said dot pattern tables expand in a first direction substantially corresponding to a direction of arrangement of nozzles of the recording head and the second direction substantially corresponding to a moving direction of the recording head. The dot pattern is a two dimensional pattern expanding in the first direction and in the second direction (column 5, lines 5-9 of Curry).

Regarding claim 37: The arguments regarding claim 36 are incorporated herein. The family of dot patterns stored in the look-up tables (column 6, line 63 to column 7, line 7 of Curry) are the dot pattern tables since they are a collection of dot patterns for a plurality of different gray levels (column 6, lines 65-66 of Curry). Said dot pattern tables are also divided according to scan position (column 6, lines 63-66 of Curry). If the sizes of the dot pattern table in said first direction and said second direction are represented by L and K, respectively, and the sizes of the dot pattern in said first direction and said second direction are represented by l and k, respectively, then the size of the dot pattern table and the size of the dot

pattern will inherently have relationships of L=αxl (α is a natural number) and K=βxk (β is a natural number). The dot patterns are two dimensional patterns, but they are also individual elements of the dot pattern tables. Since they are elements of a two dimensional table, then they would naturally have the aforementioned relationship and both α and β would be natural numbers.

Curry further discloses that the address of the look-up table is formed from the gray level value and the scan position (column 6, line 67 to column 7, line 7 of Curry). From this method of accessing, dot patterns with the same gradation value would therefore be stored in the same direction in the dot pattern table, which is stored in said look-up table.

Regarding claim 39: Curry discloses using laser or inkier printers (column 3, lines 60-63 of Curry), which would include an ink jet printer. Curry further discloses a family of dot patterns stored in the look-up tables (column 6, line 63 to column 7, line 7 of Curry), which are the dot pattern tables since they are a collection of dot patterns for a plurality of different gray levels (column 6, lines 65-66 of Curry). Said dot pattern tables are also divided according to scan position (column 6, lines 63-66 of Curry). It is inherent in the construction of an ink jet printer that there is an integer number of nozzles corresponding to the colors printed by said ink jet printer. Therefore, for a number of nozzles represented by A and a number of cells in the dot pattern represented by L, then there naturally exists a multiplicative relationship between the number of nozzles and the number of cells in the dot pattern. Such a relationship can be readily defined using any multiplicative variable, such as α. Therefore, using these

variables, there is a relationship between the number of nozzles and the number of cells given by $L=\alpha xA$. Since L and A are integers, α would be a natural number.

Regarding claim 40: Curry discloses dot pattern tables. The family of dot patterns stored in the look-up tables (column 6, line 63 to column 7, line 7 of Curry), which are the dot pattern tables since they are a collection of dot patterns for a plurality of different gray levels (column 6, lines 65-66 of Curry). Said dot pattern tables are also divided according to scan position (column 6, lines 63-66 of Curry), which is inherently two dimensional since printing is performed on paper and other two dimensional media.

When the position information indicated by the pixel is represented by two dimensional coordinates (x,y), and the x coordinate and the y coordinate correspond to the second direction and the first direction, respectively, the dot pattern selected by said second selection means is a dot pattern at a position specified based on the x coordinate value, the y coordinate value, the value α, and the value β within the dot pattern table. When said position information indicated by the pixel is represented by coordinates in the x-y plane, it is inherent that the dot pattern used to form said pixel is a dot pattern at a position specified based on the x-coordinate value and the y-coordinate value. Given a two-dimensional dot pattern table, the x-coordinate value and the y-coordinate value would correspond to a particular location within said dot pattern table. Said location would therefore correspond to a particular location value defined in terms of its relative location within the dot pattern table, which can be given the arbitrary variables of α and β.

Regarding claim 41: Curry discloses that the dot pattern tables are customized to the attributes of individual printers (column 3, lines 7-9 of Curry). For ink jet printers, one such attribute would inherently be the condition and characteristics of each of the plurality of nozzles of the recording head.

Regarding claim 42: The arguments regarding claim 41 are incorporated herein. Since the dot pattern tables are determined in consideration of the characteristics of the ink jet nozzles, and given an integer number of dot pattern tables that are not designed for any specific printer (column 2, lines 45-48 of Curry), then the number of dot pattern tables selected from the available dot pattern tables would have to be less than the total number. Therefore, if the number of dot pattern tables determined in consideration of the characteristics of each nozzle is defined by the integer H and the total number of dot patterns is defined by N, then N > H. Since N and H are inherently integers, then N and H must also therefore be natural numbers.

Regarding claims 48 and 60: Curry discloses an image recording apparatus (figure 1 of Curry) for performing recording using a dot pattern corresponding to each gradation value (column 3, lines 60-67 of Curry), based on image data representing each pixel with one of N gradation values (column 3, lines 66-67 of Curry).

Said apparatus comprises an input unit (figure 1(12) of Curry) for inputting image data (column 3, lines 60-64 of Curry) including gradation value information (column 4, lines 1-7 of Curry) and position information relating to each pixel (column 4, lines 30-39 and column 7, lines 11-14 of Curry).

Said apparatus further comprises a selection means (figure 1(52) of Curry) for selecting one dot pattern based on gradation value (intensity) information and position information (column 6, lines 63-67 of Curry) indicated by each pixel of the image data input by said input unit (figure 1(12) of Curry), from a dot pattern table storage unit (figure 1(26) of Curry). A selection of the overall number of dot patterns is taken from the family (2^{18} permutations) of available dot patterns (column 6, lines 63 to column 7, line 2 of Curry). Therefore, since a selection would necessarily be less than the original number, said storage unit stores X (N>X, X is a natural number) dot patterns. Each dot pattern has a plurality of different dot patterns since there are a plurality of possible dot patterns owing to the selection of printer (column 3, lines 7-9 of Curry) and custom corrections for intensity levels (column 3, lines 10-11 of Curry). Said dot patterns correspond to respective ones of X gradation values (column 6, line 66 to column 7, line 7 of Curry).

Said apparatus further comprises a dot pattern generation means (figure 1(20) of Curry) for generating dot patterns corresponding to (N-X) predetermined gradation values. For grayscale values which are to be printed, but which are not specifically represented by a stored dot pattern, the interpolator generates the dot patterns needed for printing (column 4, lines 1-29 of Curry). Therefore, for N gradation levels and X stored gradation values, said interpolator generates (N-X) gradation values.

Curry further discloses that when a dot pattern table corresponding to the gradation value information is stored in said dot pattern table storage unit (column 4, lines 26-29 of

Curry), the dot pattern selected by said selection means is recorded by a recording head (column 3, lines 60-63 and column 7, lines 19-25 of Curry).

Curry further discloses that when a dot pattern table corresponding to the gradation value information is not stored in said dot pattern table storage unit, dot patterns corresponding to the predetermined gradation values generated by said dot pattern generation means are recorded by the recording head (column 3, lines 60-63; column 4, lines 1-29; and column 7, lines 19-25 of Curry). When a value is not initially stored, but instead has to be generated by the dot pattern generation means (interpolator) (column 4, lines 1-29 of Curry), then new dot pattern is the dot pattern that is printed out for the corresponding gray value (column 3, lines 60-63 and column 7, lines 19-25 of Curry).

Regarding claim 49: Curry discloses that the dot pattern generation means (interpolator) (figure 1(20) of Curry) generates the dot patterns needed for grayscale values which are to be printed, but which are not specifically represented by a stored dot pattern (column 4, lines 1-29 of Curry). After said dot patterns are generated, said dot patterns are stored in a look-up table (column 4, lines 28-29 of Curry). Since they are produced to be stored and then used in printing (column 7, lines 64-67 of Curry), the dot pattern generated by said dot pattern generation means is a dot pattern having a fixed dot arrangement.

Regarding claim 50: Curry discloses that gray level ranges from all white, which would correspond to 0, and all black, which would correspond to a value of 255 for a 256 gray value range, can be processed and printed (column 5, lines 1-5 of

Curry). For the case of a gray value equal to 0, the dot pattern generated by said dot pattern generation means is a dot pattern in which no dot is recorded on all dot positions.

Regarding claim 51: Curry discloses that gray level ranges from all white, which would correspond to 0, and all black, which would correspond to a value of 255 for a 256 gray value range, can be processed and printed (column 5, lines 1-5 of Curry). For the case of a gray value equal to 255, the dot pattern generated by said dot pattern generation means is a dot pattern in which dots are recorded on all dot positions.

Regarding claims 52 and 64: Curry discloses an image recording apparatus (figure 1 of Curry) for performing recording using a dot pattern corresponding to each gradation value (column 3, lines 60-67 of Curry), based on image data representing each pixel with one of N gradation values (column 3, lines 66-67 of Curry).

Said apparatus comprises an input unit (figure 1(12) of Curry) for inputting image data (column 3, lines 60-64 of Curry) including gradation value information (column 4, lines 1-7 of Curry) and position information relating to each pixel (column 4, lines 30-39 and column 7, lines 11-14 of Curry).

Said apparatus further comprises a dot pattern table storage unit (figure 1(26) of Curry). The look-up table acts as a dot pattern table storage unit since storing dot pattern tables for the printer is a main function of said look-up table (column 4, lines 28-29; and column 6, line 67 to column 7, line 10 of Curry). A selection of the overall number of dot patterns and dot pattern tables is taken from the family (2^{18} permutations) of available dot patterns (column 7, lines 20-25 of Curry). Therefore, since a selection would necessarily be

less than the original number, said storage unit stores X (N>X, X is a natural number) dot patterns tables. Each dot pattern table has a plurality of different dot patterns since there are a plurality of possible dot patterns owing to the selection of printer (column 3, lines 7-9 of Curry) and custom corrections for intensity levels (column 3, lines 10-11 of Curry). Said dot patterns correspond to respective ones of X gradation values (column 6, line 66 to column 7, line 7 of Curry).

Said apparatus further comprises a first selection means for selecting one dot pattern table based on gradation value information indicated by each pixel of the image data input in said input unit (column 6, lines 65-66 of Curry), from among N dot pattern tables (column 6, lines 63-66 of Curry), each having a plurality of different dot patterns (column 6, lines 63-66 of Curry), corresponding to respective ones of the N gradation values (column 6, lines 65-66 of Curry). A plurality of halftone dot patterns are stored (column 6, lines 63-66 of Curry), a portion of which are selected for a particular printing operation (column 2, lines 63-66 of Curry). The gray level values relating to the particular portion of dot patterns selected is loaded into a look-up table memory for accessing during a later print operation (column 6, line 66 to column 7, line 7 of Curry).

Said apparatus further comprises a second selection means for selecting one dot pattern based on position information indicated by the pixel from the dot pattern table selected in said first selection means (column 6, lines 63-66 of Curry).

Said apparatus further comprises a dot pattern generation means (figure 1(20) of Curry) for generating dot patterns corresponding to (N-X) predetermined gradation values. For

grayscale values which are to be printed, but which are not specifically represented by a stored dot pattern, the interpolator generates the dot patterns needed for printing (column 4, lines 1-29 of Curry). Therefore, for N gradation levels and X stored gradation values, said interpolator generates (N-X) gradation values.

Curry further discloses that each of the N dot pattern tables is a two dimensional table expanding in two directions, since the various gray values are stored in the look-up table based partly on the x-y coordinate of the halftone cell (column 6, line 63 to column 7, line 2 of Curry). Printing and calculations are performed based on the fast scan and slow scan directions (column 6, lines 43-46 of Curry). In ink jet and laser jet printing (column 3, line 63 of Curry), the slow scan direction is in the direction of the recording head. For an ink jet printer, the fast scan direction is direction of the arrangement of nozzles. Therefore, said dot pattern tables expand in a first direction substantially corresponding to a direction of arrangement of nozzles of the recording head and the second direction substantially corresponding to a moving direction of the recording head.

Curry further discloses using laser or inkier printers (column 3, lines 60-63 of Curry), which would include an ink jet printer. In an ink jet printer there is an integer number of nozzles corresponding to the colors printed by said ink jet printer. Therefore, for a number of nozzles represented by A and a number of cells in a dot pattern represented by L, there naturally exists a multiplicative relationship between the number of nozzles and the number of cells in the dot pattern. Such a relationship can be readily defined using any

multiplicative variable, such as α. Therefore, using these variables, there is a relationship between the number of nozzles and the number of cells given by $L=\alpha x A$. Since L and A are integers, α would be a natural number.

Curry further discloses that when a dot pattern table corresponding to the gradation value information is stored in said dot pattern table storage unit (column 4, lines 26-29 of Curry), the dot pattern selected by said second selection means is recorded by a recording head (column 3, lines 60-63 and column 7, lines 19-25 of Curry).

Curry further discloses that when a dot pattern table corresponding to the gradation value information is not stored in said dot pattern table storage unit, dot patterns corresponding to the predetermined gradation values generated by said dot pattern generation means are recorded by the recording head (column 3, lines 60-63; column 4, lines 1-29; and column 7, lines 19-25 of Curry). When a value is not initially stored, but instead has to be generated by the dot pattern generation means (interpolator) (column 4, lines 1-29 of Curry), then new dot pattern is the dot pattern that is printed out for the corresponding gray value (column 3, lines 60-63 and column 7, lines 19-25 of Curry).

Regarding claims 56 and 68: Curry discloses an image recording apparatus (figure 1 of Curry) for performing recording using a dot pattern corresponding to each gradation value (column 3, lines 60-67 of Curry), based on image data representing each pixel with one of N gradation values (column 3, lines 66-67 of Curry). Curry further teaches printing for a pre-selected range of grayscale values (column 3, lines 66-67 of

Curry). Therefore, for grayscale printing, N has an integer equal to or larger than 3.

Said apparatus comprises an input unit (figure 1(12) of Curry) for inputting image data (column 3, lines 60-64 of Curry) including gradation value information (column 4, lines 1-7 of Curry) and position information relating to each pixel (column 4, lines 30-39 and column 7, lines 11-14 of Curry).

Said apparatus further comprises a dot pattern table storage unit (figure 1(26) of Curry). The dot pattern table storage unit stores dot pattern tables for the printer (column 4, lines 28-29; and column 6, line 67 to column 7, line 10 of Curry). A selection of the overall number of dot patterns and dot pattern tables is taken from the family (2^{18} permutations) of available dot patterns (column 7, lines 20-25 of Curry). Therefore, since a selection would necessarily be less than the original number, said storage unit stores X (N>X, X is a natural number) dot patterns tables. Each dot pattern table has a plurality of different dot patterns since there are a plurality of possible dot patterns owing to the selection of printer (column 3, lines 7-9 of Curry) and custom corrections for intensity levels (column 3, lines 10-11 of Curry). Curry teaches that the printer is initially given a series of input intensity commands corresponding to a set of reference intensity values (column 4, lines 1-4 of Curry). The values of said set of intensity values can be incremented in a variety of different ways. One way is to increment said values by every other gradation level. The interpolator (figure 1(20) of Curry) can calculate the dot patterns required for the intermediate values (column 4, lines 13-17 of Curry). Therefore, said dot patterns

correspond to X gradation values provided at every other gradation level.

Said apparatus further comprises a first selection means for selecting one dot pattern table based on gradation value information indicated by each pixel of the image data input in said input unit (column 6, lines 65-66 of Curry), from among N dot pattern tables (column 6, lines 63-66 of Curry), each having a plurality of different dot patterns (column 6, lines 63-66 of Curry), corresponding to respective ones of the N gradation values (column 6, lines 65-66 of Curry). A plurality of halftone dot patterns are stored (column 6, lines 63-66 of Curry), a portion of which are selected for a particular printing operation (column 2, lines 63-66 of Curry). The gray level values relating to the particular portion of dot patterns selected is loaded into a look-up table memory for accessing during a later print operation (column 6, line 66 to column 7, line 7 of Curry).

Said apparatus further comprises a second selection means for selecting one dot pattern based on position information indicated by the pixel from the dot pattern table selected in said first selection means (column 6, lines 63-66 of Curry).

Said apparatus further comprises a dot pattern interpolation means (figure 1(20) of Curry) for generating dot patterns corresponding to (N-X) predetermined gradation values, based on a dot pattern within the dot pattern table corresponding to a gradation value larger than a corresponding one of the predetermined gradation values by one, and a dot pattern within the dot pattern table corresponding to a gradation value smaller than the corresponding one of the predetermined gradation values by one. For grayscale values

which are to be printed, but which are not specifically represented by a stored dot pattern, the interpolator generates the dot patterns needed for printing based on an curve that interpolated between the selected values (figure 2a, figure 2b and column 4, lines 1-29 of Curry). If, as mentioned above, the pre-selected dot patterns correspond to every other gradation level, then the interpolated dot pattern is based on the dot patterns for a value one above the target value and one below the target value. Therefore, for N gradation levels and X stored gradation values, said interpolator generates (N-X) gradation values.

Curry further discloses that each of the N dot pattern tables is a two dimensional table expanding in two directions, since the various gray values are stored in the look-up table based partly on the x-y coordinate of the halftone cell (column 7, lines 2-5 of Curry). Printing and calculations are performed based on the fast scan and slow scan directions (column 6, lines 43-46 of Curry). It is inherent in ink jet and laser jet printing (column 3, line 63 of Curry) that the slow scan direction is in the direction of the recording head. For an ink jet printer, it is inherent that the fast scan direction is direction of the arrangement of nozzles. Therefore, said dot pattern tables expand in a first direction substantially corresponding to a direction of arrangement of nozzles of the recording head and the second direction substantially corresponding to a moving direction of the recording head.

Curry discloses using laser or inkier printers (column 3, lines 60-63 of Curry), which would include an ink jet printer. Curry further discloses a family of dot patterns stored in the look-up tables (column 6, line 63 to column 7, line 7 of Curry),

which are the dot pattern tables since they are a collection of dot patterns for a plurality of different gray levels (column 6, lines 65-66 of Curry). Said dot pattern tables are also divided according to scan position (column 6, lines 63-66 of Curry). It is inherent in the construction of an ink jet printer that there is an integer number of nozzles corresponding to the colors printed by said ink jet printer. Therefore, for a number of nozzles represented by A and a number of cells in the dot pattern represented by L, then there naturally exists a multiplicative relationship between the number of nozzles and the number of cells in the dot pattern. Such a relationship can be readily defined using any multiplicative variable, such as α. Therefore, using these variables, there is a relationship between the number of nozzles and the number of cells given by $L=\alpha xA$. Since L and A are integers, α would be a natural number.

Curry further discloses that when a dot pattern table corresponding to the gradation value information is stored in said dot pattern table storage unit (column 4, lines 26-29 of Curry), the dot pattern selected by said selection means is recorded by a recording head (column 3, lines 60-63 and column 7, lines 19-25 of Curry).

Curry further discloses that when a dot pattern table corresponding to the gradation value information is not stored in said dot pattern table storage unit, dot patterns corresponding to the predetermined gradation values generated by said dot pattern generation means are recorded by the recording head (column 3, lines 60-63; column 4, lines 1-29; and column 7, lines 19-25 of Curry). When a value is not initially stored, but instead has to be generated by the dot pattern generation means (interpolator) (column 4, lines 1-29 of Curry), then new

dot pattern is the dot pattern that is printed out for the corresponding gray value (column 3, lines 60-63 and column 7, lines 19-25 of Curry).

Regarding claims 90-92: Curry discloses an input step for inputting image data (column 3, lines 60-64 of Curry) including gradation value information (column 4, lines 1-7 of Curry) and position information relating to each pixel (column 4, lines 30-39 and column 7, lines 11-14 of Curry); a selection step for selecting one dot pattern (column 7, lines 14-22 of Curry), based on gradation value information (v of (x,y,v) set of coordinates) and position information ((x,y) of (x,y,v) set of coordinates) (column 7, lines 20-24 of Curry) indicated by each pixel of the image data input in said input step (column 7, lines 11-18 of Curry) from a dot pattern table (figure 1(26) of Curry) having a plurality of different dot patterns (column 6, line 67 to column 7, line 7 of Curry) associated with gradation value (8-bit intensity) and pixel position (5-bit x-coordinate and 5-bit y-coordinate) (column 6, lines 63-67 of Curry). The dot-pattern-table has 2^{18} permutations of halftone cell configurations, with 18 bits for addressing the permutations (column 6, lines 63-67 of Curry). 8 bits are used for the grayscale (intensity) values (column 6, lines 65-66 of Curry) and 10-bits are used for the position information of the halftone cell, 5 bits for the x-coordinate and 5 bits for the y-coordinate (column 6, lines 63-67 of Curry).

Curry further discloses a recording step for recording an ink dot based on the dot pattern selected in said selection step on a recording medium using a recording head (column 7, lines 22-25 of Curry), wherein the dot pattern table has a plurality of different dot patterns (column 6, lines 63-66 of Curry), each

having the same dot number and a different dot arrangement corresponding to the same gradation value (column 6, line 67 to column 7, line 7 of Curry). For a 5-bit representation of x-coordinates, a 5-bit representation of y-coordinates, and an 8-bit representation of gradation values, there are 2^{18} permutations, and thus memory addresses, of dots. Therefore, there are 2^{10} permutations of dot arrangements for each gradation level.

Curry further discloses that the dot pattern table is repeatedly used at each of a plurality of pixels in a first direction substantially corresponding to a direction of arrangement of a nozzle of the recording head and is repeatedly used at each of a plurality of pixels in a second direction orthogonal to the first direction (column 6, lines 43-46 and column 7, lines 3-7 of Curry). The dot pattern table is a two dimensional table expanding in two directions, since the various gray values are stored in the look-up table based partly on the x-y coordinate of the halftone cell (column 7, lines 3-7 of Curry). Printing and calculations are performed based on a first (fast scan) direction and a second (slow scan) direction, said second direction orthogonal to the first direction (column 6, lines 43-46 of Curry). It is inherent in ink jet and laser jet printing (column 3, line 63 of Curry) that the fast scan direction is in the direction of the arrangement of a nozzle of the recording head. Since the x-coordinate and the y-coordinate of the halftone cell are both 5 bits and a plurality of halftone cells are clearly required to process a normal image, said dot pattern table is therefore repeatedly used in order to process the image.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 38 and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,696,604) in view of Parker (US Patent 5,341,228).

Regarding claim 38: Curry does not disclose expressly that said dot pattern is repeatedly used at every L pixels in the first direction and every K pixels in the second direction.

Parker discloses a blue noise mask array (column 7, lines 54-62 of Parker) that is repeatedly used over the entire image space every number of pixels in a first and every number of pixels in a second direction (column 8, lines 14-20 of Parker).

Curry and Parker are combinable because they are from the same field of endeavor, namely gray scale image processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a dot pattern table, as taught by Curry, but make said dot pattern table smaller than the overall image, such as with the blue noise mask taught by Parker. Said dot pattern table could then be used repeatedly over the entire space of the image, in the manner taught by Parker for the blue noise mask. The motivation for doing so would have been to provide a simple and reliable mechanism for halftone processing (column 5, lines 61-64 of Parker).

Therefore, it would have been obvious to combine Parker with Curry to obtain the invention as specified in claim 38.

Regarding claim 46: Curry does not disclose expressly that said dot pattern table has a blue noise characteristic.

Parker discloses the use of a blue noise characteristic in gray scale halftoning (column 5, lines 38-45 of Parker).

Curry and Parker are combinable because they are from the same field of endeavor, namely gray scale halftoning. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply a blue noise characteristic to the dot pattern tables that are produced for the printing operations. The motivation for doing so would have been that blue noise characteristics reduce undesirable printing effects (column 5, lines 45-53 of Parker). Therefore, it would have been obvious to combine Parker with Curry to obtain the invention as specified in claim 46.

Further regarding claim 47: Parker discloses that the blue noise characteristic is a characteristic in which a power spectrum in a low frequency region of an image recorded based on the image data is smaller than a power spectrum of a high frequency region (figure 1; column 6, lines 66-68; and column 9, lines 42-58 of Parker).

6. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,696,604) in view of Hayashi (US Patent 5,801,845).

Regarding claim 43: Curry discloses that the dot pattern tables are customized to the attributes of individual printers (column 3, lines 7-9 of Curry). For ink jet printers, one such

attribute would inherently be the condition and characteristics of each of the plurality of nozzles of the recording head.

Curry does not disclose expressly that said dot pattern table corresponds to a gradation value such that a ratio of dots D (%) provided within a pixel is within a range of 25<=D<=50.

Hayashi discloses printing for gradation values that are between a lower bound and an upper bound (figure 4a and column 8, lines 20-37 of Hayashi). Said lower bound is set based on the ability of the ink to adhere to the paper (column 8, lines 38-46 of Hayashi). Said upper bound is set based on the ability of the ink to not saturate in printing on the paper (column 8, lines 47-55 of Hayashi).

Curry and Hayashi are combinable because they are from the same field of endeavor, namely halftone and grayscale printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to set the overall gradation value for the dot pattern table such that a ratio of dots provided within a pixel is within a range that allows for the proper and smooth operation of the ink jet nozzles. Setting said range to between and including 25% to 50% would have been a reasonable and obvious choice for processing a set of gradation levels. The motivation for doing so would have been so that printing is only performed when the ink can properly adhere to the paper (column 8, lines 38-46 of Hayashi) and not performed in such a way as to attempt to add ink when the paper is already saturated (column 8, lines 47-55 of Hayashi). Therefore, it would have been obvious to combine Hayashi with Curry to obtain the invention as specified in claim 43.

7. Claims 44-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,696,604) in view of Kelly (US Patent 5,528,387).

Regarding claim 44: Curry does not disclose expressly that cells in the second direction (moving direction of the recording head) from among cells positioned at end portions of the dot pattern table do not include dot information.

Kelly discloses that edges are faded out to prevent black wedges in the printed output when the document image is skewed (column 8, lines 31-36 of Kelly). This would prevent cells positioned at end portions of the document from containing dot information since they are not to be printed.

Curry and Kelly are combinable because they are from the same field of endeavor, namely halftone printing and image processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to remove dot information from cells positioned at the end portions of the dot pattern tables. The motivation for doing so would have been to fade printing at edges of dot pattern tables and prevent black wedges in the printed output (column 8, lines 34-36 of Kelly). Therefore, it would have been obvious to combine Kelly with Curry to obtain the invention as specified in claim 44.

Regarding claim 45: The arguments regarding claim 44 are incorporated herein. If the cells in the second direction from among cells positioned at end portions of the dot pattern table do not include dot information, then the gradation value of the dot pattern formed from said cells would inherently be smaller than the gradation value indicated by the dot pattern table where the dot pattern is stored. The dot pattern stored in the dot pattern table is outputted, but the cells in the second

direction from among cells positioned at end portions of the dot pattern table are prevented from having dots printed for their respective locations. This lowers the overall number of dots printed for the output dot pattern, resulting in a lower gradation value.

8. Claims 78-80, 82 and 84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,696,604) in view of Broddin (US Patent 5,799,137).

The apparatus of claim 78 performs the method of claim 84. Claims 78 and 84 are therefore discussed together.

Regarding claims 78 and 84: Curry discloses an image recording apparatus (figure 1 of Curry) for outputting dot patterns corresponding to respective gradation values (column 3, lines 60-67 of Curry) and recording the output dot pattern by a recording unit (figure 1(10) of Curry), based on image data representing each pixel with one of N gradation values (column 3, lines 66-67 of Curry).

Said image recording apparatus comprises an input unit (figure 1(12) of Curry) for inputting image data (column 3, lines 60-64 of Curry) including position information (column 4, lines 30-39 and column 7, lines 11-14 of Curry) and gradation information (column 4, lines 1-7 of Curry) relating to each pixel.

Said apparatus further comprises a dot pattern table storage unit (figure 1(26) of Curry) for storing N dot pattern tables (column 6, line 66 to column 7, line 7 of Curry), each having a plurality of different dot patterns corresponding to respective ones of the N gradation values (column 6, lines 63-66 of Curry). The family of halftone dot patterns for each

gradation level form dot pattern tables since said family of halftone dot patterns comprises a plurality of different dot patterns (column 6, lines 63-66 of Curry), each of which are arranged according to the scan position of the individual dot pattern (column 7, lines 2-7 and column 8, lines 21-30 of Curry).

Said image recording apparatus further comprises an output unit (figure 1(10) of Curry) for outputting one dot pattern from said dot pattern table storage unit, based on position information and gradation value information indicated by each pixel of the image data input by said input unit (column 8, lines 21-33 of Curry). Said output unit can also inherently be considered a recording unit since the functions are essentially the same. The difference is between the output unit and the recording unit is one of semantics.

Curry does not disclose expressly that dot patterns are output by a recording unit using recording materials having a plurality of colors; that said input unit also inputs color information relating to each pixel; that a plurality of different dot patterns is also formed for each color of the recording materials; that said output unit outputs a dot pattern further based on color information; and that a size of a dot pattern table corresponding to at least one specific color from among the dot pattern tables stored for each of the plurality of colors is smaller than sizes of dot pattern tables corresponding to colors other than the specific color.

Broddin teaches using a plurality of colors for the purpose of image reproduction (column 2, lines 31-34 of Broddin). Broddin further teaches that artifacts such as Moiré patterns are reduced for lighter colors, such as yellow (column 9, lines

35-40 and column 8, lines 27-34 of Broddin). For CMYK printing, the effects due to the yellow color component are not considered important.

Curry and Broddin are combinable because they are from the same field of endeavor, namely image halftoning and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a plurality of colors in printing an image, have the input unit further input color information, have the dot pattern table storage unit store dot patterns tables relating to each color, and have the output unit output dot patterns further based on the color information indicated by each pixel of the image data. The motivation for doing so would have been to be able to print in multiple colors (column 2, lines 31-34 of Broddin). Furthermore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a smaller size for the dot pattern tables of a specific color, such as yellow for CMYK printing, that is lighter than the other colors used in printing. The suggestion for doing so would have been that the lighter colors in printing are less critical in terms of problems relating to printing artifacts (column 9, lines 35-40 of Broddin). A smaller, and therefore less complex, dot pattern table is needed to reduce the problems that arise from printing artifacts for said lighter colors. Therefore, it would have been obvious to combine Broddin with Curry to obtain the invention as specified in claims 78 and 84.

Further regarding claim 84, for said output unit (recording unit) of the image recording apparatus to output a dot pattern, it must inherently have a recording step for recording the dot pattern. Otherwise, no dot pattern can be output.

Regarding claim 79: Curry does not disclose expressly that the specific color, initially disclosed in claim 78, is a color having a relatively high lightness from among the plurality of colors.

Broddin discloses that the specific color is a color that is less dense, and thus inherently having a relatively higher lightness, such as yellow for CMYK printing (column 9, lines 35-40 of Broddin).

Curry and Broddin are combinable because they are from the same field of endeavor, namely image halftoning and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a color having a relatively higher lightness for the specific color. The suggestion for doing so would have been that the lighter colors in printing are less critical in terms of problems relating to printing artifacts (column 9, lines 35-40 of Broddin). Therefore, it would have been obvious to combine Broddin with Curry to obtain the invention as specified in claim 79.

Regarding claim 80: Curry does not disclose expressly that the colors of the recording materials are four colors, i.e. cyan, magenta, yellow and black, and wherein the specific color is yellow.

Broddin discloses recording images in four colors, i.e. cyan, magenta, yellow and black (column 8, lines 41-43 of Broddin). The specific color is a color that is less dense, specifically yellow for CMYK printing (column 9, lines 35-40 of Broddin).

Curry and Broddin are combinable because they are from the same field of endeavor, namely image halftoning and printing. At the time of the invention, it would have been obvious to a

person of ordinary skill in the art to use yellow for the specific color if CMYK printing was being performed. The suggestion for doing so would have been that yellow in CMYK printing is less critical in terms of problems relating to printing artifacts (column 9, lines 35-40 of Broddin). Therefore, it would have been obvious to combine Broddin with Curry to obtain the invention as specified in claim 80.

Regarding claim 82: Curry discloses that the recording head is an ink jet recording head for performing recording by discharging ink (column 3, lines 63-67 of Curry). Curry teaches the use of a plurality of possible printers (column 3, lines 64-66 of Curry) and prefers laser and inkier printers (column 3, line 63 of Curry), which would include an ink jet printer.

9. Claims 81 and 83 are rejected under 35 U.S.C. 103(a) as being unpatentable over Curry (US Patent 5,696,604) in view of Broddin (US Patent 5,799,137) and Slade (US Patent 5,982,993).

Regarding claim 81: Curry does not disclose expressly that the colors of the recording materials are six colors, i.e. cyan, light cyan, magenta, light magenta, yellow and black, and wherein the specific colors are light cyan, light magenta, and yellow.

Broddin discloses that the specific color is a color that is less dense, and thus inherently having a relatively higher lightness, such as yellow for CMYK printing (column 9, lines 35-40 of Broddin).

Curry and Broddin are combinable because they are from the same field of endeavor, namely image halftoning and printing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a color having a

relatively higher lightness for the specific color. The suggestion for doing so would have been that the lighter colors in printing are less critical in terms of problems relating to printing artifacts (column 9, lines 35-40 of Broddin). Therefore, it would have been obvious to combine Broddin with Curry.

Curry in view of Broddin does not disclose expressly that the colors of the recording materials are six colors, i.e. cyan, light cyan, magenta, light magenta, yellow and black; and that the specific colors are light cyan, light magenta, and yellow.

Slade discloses printing with six colors, namely cyan, light cyan, magenta, light magenta, yellow and black (column 3, line 66 to column 4, line 3 of Slade).

Curry in view of Broddin is combinable with Slade because they are from the same field of endeavor, namely halftoning and image processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to print using cyan, light cyan, magenta, light magenta, yellow and black. The motivation for doing so would have been to create an image that more accurately portrays the original (column 4, lines 3-8 of Slade). Furthermore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to use light cyan, light magenta and yellow as the specific colors. The motivation for doing so would have been that light cyan, light magenta and yellow are the colors with higher relative lightness (column 3, line 66 to column 4, line 3 of Slade; and column 9, lines 35-40 of Broddin) and would therefore be less critical in terms of problems relating to printing artifacts (column 9, lines 35-40 of Broddin). Therefore, it

would have been obvious to combine Slade with Curry in view of Broddin to obtain the invention as specified in claim 81.

Regarding claim 83: Curry discloses that the recording head is an ink jet recording head for performing recording by discharging ink (column 3, lines 63-67 of Curry). Curry teaches the use of a plurality of possible printers (column 3, lines 64-66 of Curry) and prefers laser and inkier printers (column 3, line 63 of Curry), which would include an ink jet printer.

Curry in view of Broddin does not disclose expressly that the ink is discharged by utilizing thermal energy, and that a thermal energy generation member generates the thermal energy provided to the ink.

Slade discloses using a thermal ink jet printer (column 3, lines 56-59 of Slade). A thermal ink jet printer inherently has some form of thermal energy generation member that generates the thermal energy that is provided to the ink for the purpose of discharging said ink from the recording heads.

Curry in view of Broddin is combinable with Slade because they are from the same field of endeavor, namely printing and image processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a thermal ink jet printer for printing the output image, formed of the output dot patterns. The motivation for doing so would have been that a thermal printer is one of a plurality of useful types of printers for printing color images (column 3, lines 58-62 of Slade). Therefore, it would have been obvious to combine Slade with Curry in view of Broddin to obtain the invention as specified in claim 83.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A Thompson whose telephone number is 703-305-6329. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K Moore can be reached on 703-308-7452. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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James A. Thompson
Examiner
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JAT
10 March 2005

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PRIMARY EXAMINER